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DIOPHANTINE ANALYSIS.

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70. Proposed by CHARLES CARROLL CROSS, Libertytown, Md.

Give methods for decomposing numbers into squares, cubes, or biquadates and show that 61×200^3 is the sum of ten cube numbers and that 844933 is the sum of eleven biquadrates in thirteen different ways. [From *The Mathematical Magazine*, Vol. II, No. 10.]

Solution by the PROPOSER.

Let s_1=sum of products taking 1 number at a time ....(1),
s_2=sum of products taking 2 numbers at a time................(2),
s_3=sum of products taking 3 numbers at a time................(3),
....
s_n=sum of products taking n numbers at a time................(n).

Then $a+b+c+d......n=s_1$ ....(b_1),

(1)(b_1)$-$2(2) gives

$a^2+b^2+c^2+d^2$ .....$n^2=s_1^2-2s_2$ ....(b_2),

(1)(b_2)$-$[(2)(b_1)$-$3(3)] gives

$a^3+b^3+c^3+d^3$..... $n^3=s_1^3-3s_1s_2+3s_3$ ....(b_3),

(1)(b_3)$-$[(2)(b_2)$-$(3)(b_1)$-$4(4)] gives

$a^4+b^4+c^4+d^4$..... $n^4=s_1^4-4s_1^2s_2+4s_1s_3+2s_2^2+4s_4$ ....(b_4),

(1)(b_4)$-$[(2)(b_3)$-$(3)(b_2)$-$(4)(b_1)$-$5(5)] gives

$a^5+b^5+c^5+d^5......n^5=s_1^5-5s_1^3s_2+5s_1^2s_3+5s_1s_2^2+5s_1s_4-5s_2s_3+5s_5$ ..(b_5),

etc. etc. etc.

[In (b_5) let $s_1=x$, $s_2=-xy$, $s_3=2xy^2$, $s_4=y^2(x^2-y^2)$, and $s_5=\frac{1}{5}y^5$, then $a^5+b^5+c^5+d^5+e^5+f^5=(x+y)^5$. This answers Dr. Drummond's note on page 182, Vol. V., of the MONTHLY.]

71. Proposed by A. H. BELL, Hillsboro, Ill.

Find five numbers such that the product of any two plus 1 will equal a square.

I. Partial Solution by CHARLES C. CROSS, Libertytown, Md.

We readily find four numbers to be $(n-1)$, $(n+1)$, $4n$, and $4n(4n^2-1)$.

Let n=2, 3, 4, and so on, and we get

1,	3,	8,	120,	also	1,	8,	15,	528,
2,	4,	12,	420,		2,	12,	24,	2380,
3,	5,	16,	1008,		3,	16,	33,	6440,
4,	6,	20,	1980,		4,	20,	42,	13572,
	etc., etc.					etc., etc.		

From which we get a more general formula for four numbers and find it to be, m, $n^2-1+(m-1)(n-1)^2$, $n(mn+2)$, $m(m^2n-2mn+mn^2+4n-2)^2+(m^2n-2mn+mn^2+4n-2)$.